

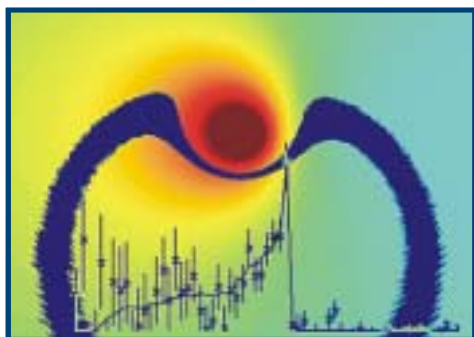
Constellation-X



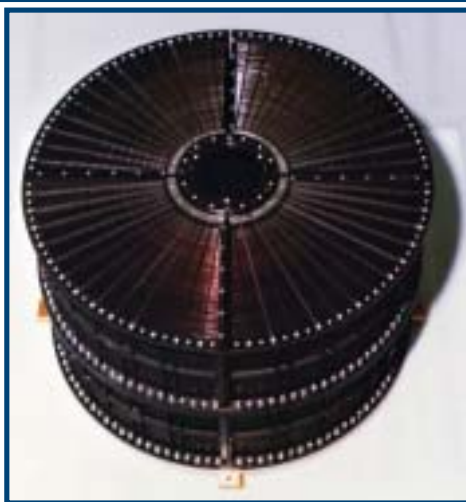
High throughput, high resolution X-ray spectroscopy

Constellation-X Science

A major goal of science is to understand how our Universe arrived at its present state and to understand its ultimate destiny. Exploring and expanding our cosmic horizons requires sensitive X-ray observations. Constellation-X is a key element in NASA's Structure and Evolution of the Universe (SEU) theme aimed at understanding the great mysteries of space, time, and energy. Constellation-X is 25 to 100 times more sensitive than Chandra for high resolution spectroscopy.



When observations commence towards the end of this decade, Constellation-X will address many pressing questions concerning the extremes of gravity and the evolution of the Universe. X-ray observations of broadened iron emission lines in Active Galactic Nuclei will measure black hole masses and spins and will test General Relativity in the strong gravity limit. Constellation-X will show us how black holes evolve with cosmic time and, as accretion energy may be a dominant component, will provide critical information on the total energy output of the Universe. By looking across a broad range of redshift, Constellation-X will reveal the earliest formation of clusters of galaxies and tell us whether their properties are consistent with current models of galaxy formation. Present inventories indicate that many of the baryons predicted by Big Bang nucleosynthesis and subsequent stellar processing seem to be "missing," and Constellation-X will allow us to search for them—for example, in a hot, metal-enriched Intergalactic Medium.



Constellation-X Technology

Key technologies relating directly to the Constellation-X science instruments and spacecraft include state-of-the-art X-ray mirrors, multilayer coatings, spectrometers, low-energy and high-energy X-ray detectors, cryogenic systems, lightweight satellite buses, and advanced communications systems. Development efforts in each area will benefit a variety of NASA programs in addition to Constellation-X.

The specific Constellation-X mission requirements that drive the Technology Roadmap are its large effective area, high spectral resolution, and broad energy bandpass. These requirements can be met by using replicated optics, reflection gratings, multilayers for HXT optics, charge-coupled device detectors (CCDs), quantum microcalorimeters, and cadmium zinc telluride (CZT) or silicon hard X-ray detectors.

Constellation-X uses a Wolter Type I design of nested, grazing-incidence X-ray mirrors to focus X-rays. The Constellation-X mirror program is pursuing a segmented shell approach to produce lightweight, high throughput X-ray optics.

<http://constellation.gsfc.nasa.gov>

Mission Baseline

- ◆ *Effective Area:* 15,000 cm² at 1 keV; 6,000 cm² at 6.4 keV; 1,500 cm² at 40 keV.
- ◆ *Band Pass:* 0.25 to 60 keV
- ◆ *Spectral Resolving Power (E/ΔE):* 300-1500 from 0.25 to 10 keV; > 10 between 10 and 40 keV
- ◆ *Telescope Angular Resolution:* 5"-15" HPD from 0.25 to 10 keV; 1' above 10 keV
- ◆ *Mission Life:* > Five years at full capability.

Constellation-X Observatory

In order to obtain the desired high throughput in the most cost effective manner, a "constellation" of four identical spacecraft will be placed at the L2 point and will act in concert simultaneously to observe each X-ray source.

Constellation-X is envisioned as an international facility, open to all scientists. Satellites will be launched in pairs, aboard Delta IV or Atlas V launch vehicles, beginning about 2010, with all four in place in 2011.

